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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Site Index Curves for Douglas-fir in New Mexico

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Presents a figure, table, and FORTRAN subroutine for estimating site indexes for Douglas-fir stands in New Mexico. Site index is expressed as the average height of dominant trees at a breast-height age of 100 years.

Keywords: *Pseudotsuga menziesii,* site index, site quality.

Forest site quality and productive capacity are commonly measured by site index. The only published site index curves for inland Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco) apply to the northern and central Rocky Mountains (Brickell 1968).

This Note presents the basic height-age curves needed to classify Douglas-fir stands in New Mexico according to site index.

Source of Data and Analysis

The height-age curves were developed by the anamorphic curve technique described by Chapman and Meyer (1949). Age at breast height (4.5 feet) was used, rather than total age, because it is determined after the initial period of tree establishment. Only dominant trees were included in the sample since they are the most reliable indicators of site productivity. A breast height age of 100 years was selected as the base age for the height-age curves because it most nearly approximates the expected rotation age for managed stands of Douglas-fir in the southern Rocky Mountains.

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Total height in feet and breast height age in years were measured on 660 Douglas-fir trees in Colfax and San Miguel Counties of northern and central New Mexico. Trees sampled had to be in the dominant portion of the stand, and appear to be free of injury, disease, and past suppression that would adversely affect height growth. Sample trees ranged in height from 20 to 92 feet, and in breast height age from 26 to 200 years old.

The height-age data were sorted into 10-year age groups, and the average height and age were determined for each group. The average height of each group was plotted over its corresponding average age. The number of trees in each group was used as a weighting factor for each point before a balanced guide curve was fitted to the points.

Before drawing the family of site index curves, we examined the assumption that the height-age curves for different sites are proportional to the shape of the guide curve. We used the method described by Chapman and Meyer (1949). The plot of the coefficient of variation of height over the average age for each group supported the assumption of proportional shape. The assumption that no correlation exists between site quality and tree age of the sampled trees was also examined by plotting site over age. No trend was apparent and the correlation coefficient of site index and tree age was not different from zero, therefore the assumption appears valid.

The site index curves developed from the guide curve are shown in figure 1. Table 1 shows the expected height of trees in the dominant stand at breast height ages 20 to 250 years for site indexes 30 to 120 at base age 100 years.
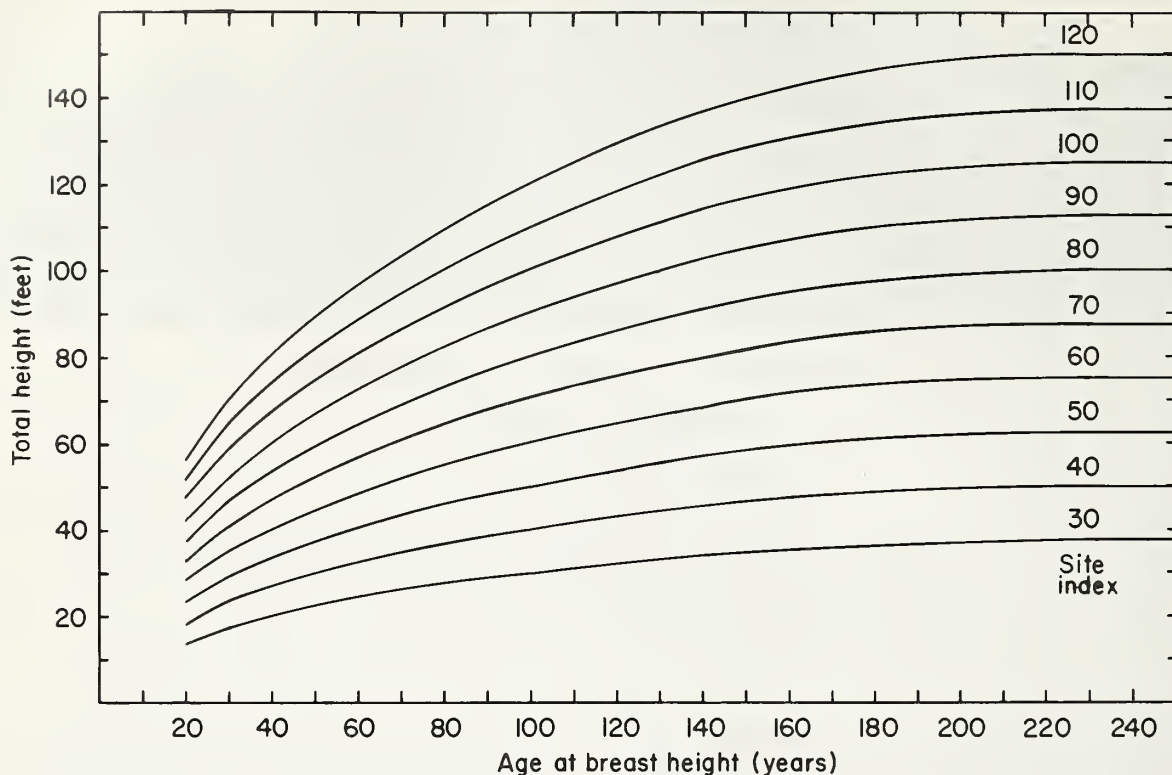
Figure 1.—Site index curves for Douglas-fir in New Mexico. Base age: 100 years, breast height.

Table 1.--Expected height of Douglas-fir trees in the dominant stand

Breast height age (Years)	Site index class									
	30	40	50	60	70	80	90	100	110	120
	Height in feet									
20	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0	51.7	56.4
30	17.6	23.4	29.3	35.1	41.0	46.9	52.7	58.6	64.4	70.3
40	20.1	26.8	33.5	40.2	46.9	53.6	60.3	67.0	73.7	80.4
50	22.3	29.7	37.1	44.5	52.0	59.4	66.8	74.2	81.6	89.1
60	24.1	32.2	40.2	48.3	56.3	64.4	72.4	80.5	88.5	96.6
70	25.8	34.4	43.0	51.6	60.2	68.8	77.4	86.0	94.6	103.2
80	27.3	36.5	45.6	54.7	63.8	72.9	82.0	91.2	100.3	109.4
90	28.7	38.3	47.9	57.5	67.0	76.6	86.2	95.8	105.3	114.9
100	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0
110	31.2	41.5	51.9	62.3	72.7	83.1	93.5	103.9	114.3	124.6
120	32.3	43.0	53.8	64.5	75.3	86.0	96.8	107.6	118.3	129.1
130	33.3	44.3	55.4	66.5	77.6	88.7	99.8	110.9	122.0	133.0
140	34.1	45.5	56.9	68.3	79.7	91.0	102.4	113.8	125.2	136.6
150	34.9	46.6	58.2	69.8	81.5	93.1	104.8	116.4	128.0	139.7
160	35.6	47.4	59.3	71.2	83.0	94.9	106.7	118.6	130.5	142.3
170	36.1	48.2	60.2	72.3	84.3	96.4	108.4	120.4	132.5	144.5
180	36.6	48.8	61.0	73.1	85.3	97.5	109.7	121.9	134.1	146.3
190	36.9	49.2	61.5	73.8	86.1	98.4	110.7	123.0	135.3	147.6
200	37.1	49.5	61.9	74.3	86.6	99.0	111.4	123.8	136.1	148.5
210	37.3	49.7	62.2	74.6	87.0	99.4	111.9	124.3	136.7	149.2
220	37.4	49.9	62.3	74.8	87.3	99.7	112.2	124.7	137.1	149.6
230	37.5	49.9	62.4	74.9	87.4	99.9	112.4	124.9	137.3	149.8
240	37.5	49.9	62.4	74.9	87.4	99.9	112.4	124.9	137.3	149.8
250	37.5	49.9	62.4	74.9	87.4	99.9	112.4	124.9	137.3	149.8

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Field Application

To determine site index for a Douglas-fir stand, average height and age should be computed from measurements of total height and breast height age of at least six of the taller dominants in the stand (Johnson and Carmean 1953). If the average age of the trees is greater than 250 years, an age of 250 should be used for site index determination. The trees should be growing on the same apparent site as indicated by similar soils, topography, slope, and aspect. Trees selected for measurement should be even-aged (not more than a 20-year spread in age), and show no evidence of disease, crown damage, or excessive sweep or crook. The increment cores removed for aging should indicate no evidence of extended suppression or injury.

Computer Application

The listing of DFSITE, a FORTRAN subroutine to determine site index for a stand, appears below. Input parameters to the subroutine are average height (HT) and average breast height age (AGE) of the sampled trees. The site index of the stand is returned as output parameter SITE. The calling statement to use the subroutine has the form:

CALL DFSITE (HT,AGE,SITE)

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SUBROUTINE DFSITE (HT,AGE,SITE)
DIMENSION HTSI (25)
DATA HTSI/4.5,15.0,25.5,31.8,36.4,40.3,43.7,46.7,49.5,52.0,54.3,56
1.4,58.4,60.2,61.8,63.2,64.4,65.4,66.2,66.8,67.2,67.5,67.7,2*67.8/
TEM = AGE + 0.001
IF(TEM.GT.230.001)TEM = 230.001
I1 = (IFIX(TEM)/10) + 1
I2 = I1 + 1
A1 = FLOAT(I1-1)*10.0
A2 = A1 + 10.0
HTSIA = (HTSI(I1)*(TEM-A2)-HTSI(I2)*(TEM-A1))/(A1-A2)
SITE = 54.3*HT/HTSIA
RETURN
END
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